

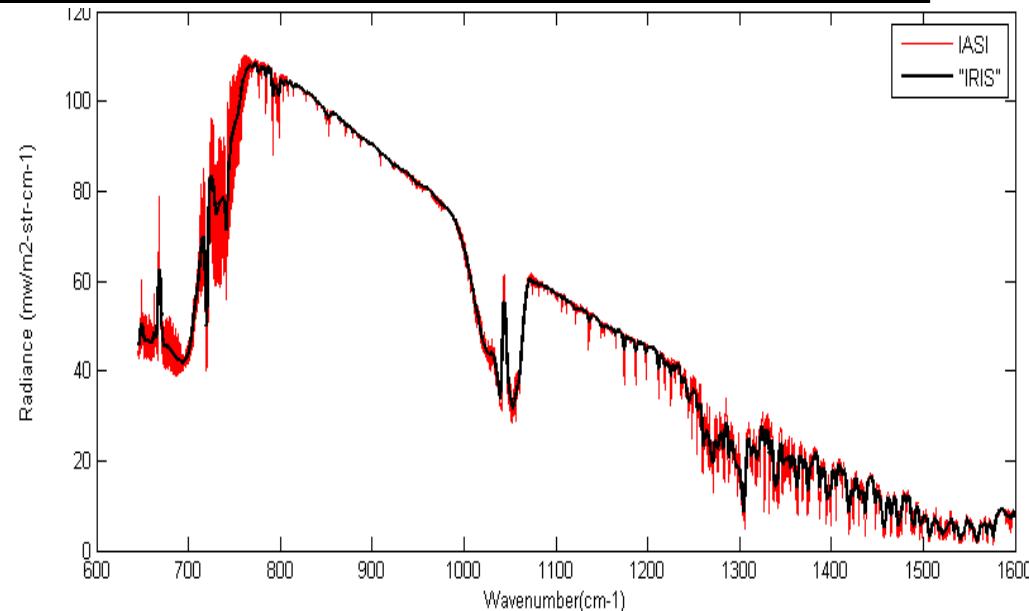
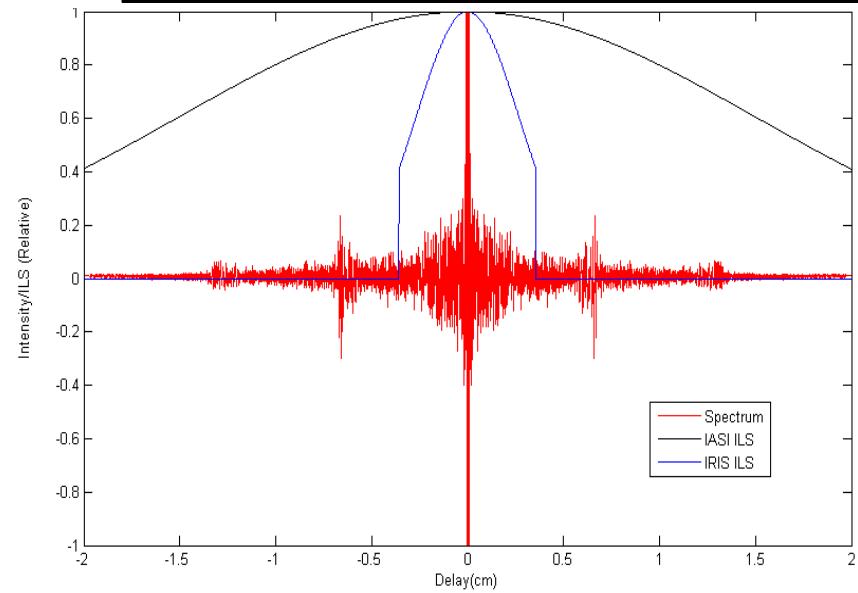
CLARREO - State Parameter Climate Retrieval

Desirable Features of Climate Retrieval Algorithm

- ***Linear dependence on radiance spectra (EOFs)***
 - Variation depends only on radiance
(i.e., no other input variables)
- ***All sky***
 - clear and cloudy (0 - 100%)
- ***Independent of Field-of-View (FOV) size***
 - Can be applied to different instruments
- ***Retrieval Variables***
 - Surface : temperature & spectral emissivity
 - Atmosphere : T, H₂O, and O₃ profiles & CO₂ ppm
 - Cloud : height, optical depth, and particle diameter

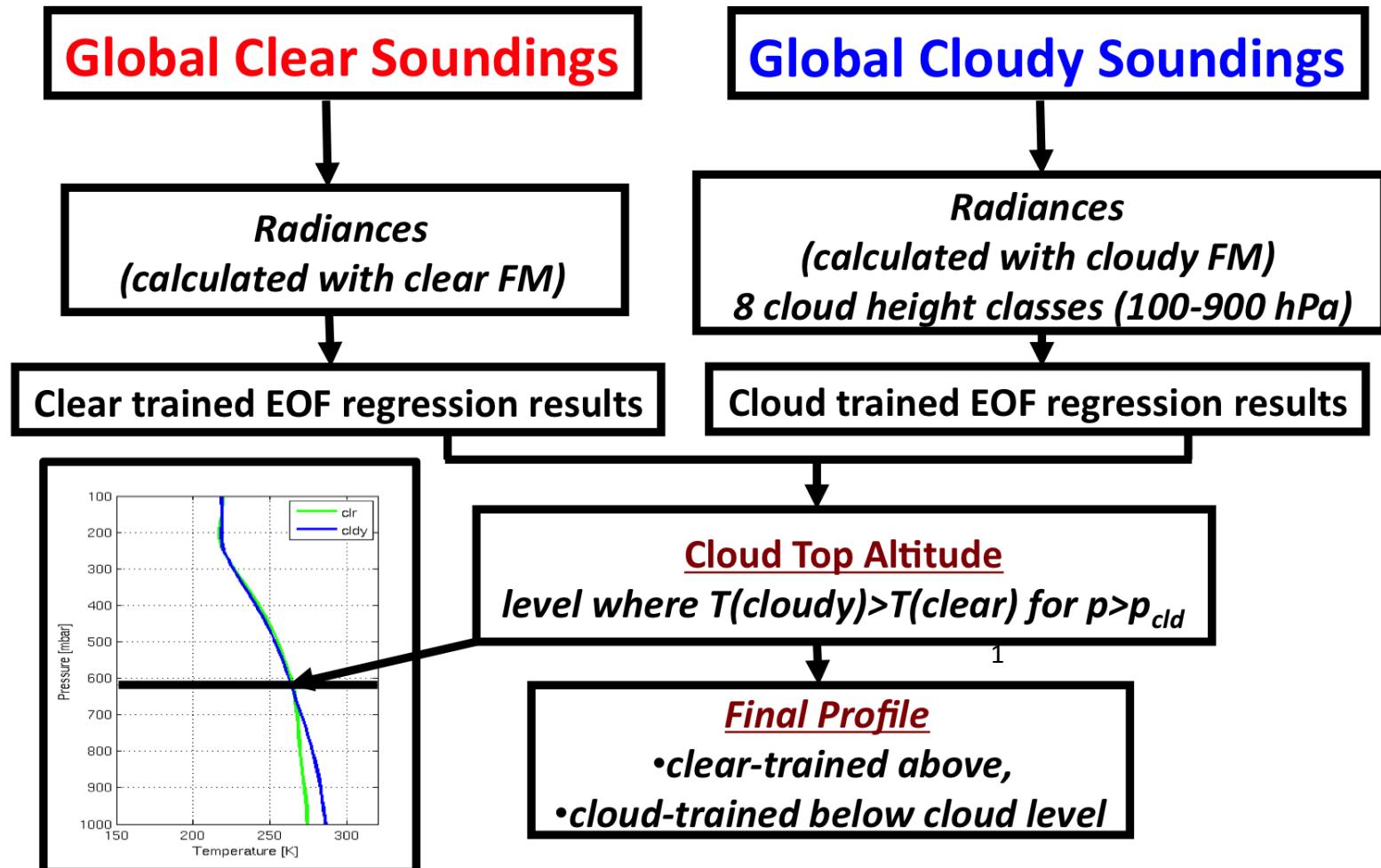
Satellite Instrument Characteristics

Instrument	Spatial resolution	spectral res. (cm^{-1})	spectral rng. (cm^{-1})	spatial sampling
IRIS (1970)	100 km	1.40	400-1600	Nadir
AIRS (2002 -)	3x3 13.5-km (50 km)	~1200 resolving power	645-2700	Contiguous Cross-track scan
IASI (2006 -)	2x2 12.0-km (50 km)	0.25	645-2760	Contiguous Cross-track Scan
CrIS (2011 -)	3 x 3 13-km (50 km)	0.6	645-2700	Contiguous Cross-track
CLARREO (??)	25 to 100-km (TBD km)	0.5	200-2700	Nadir



Technique – Dual Regression

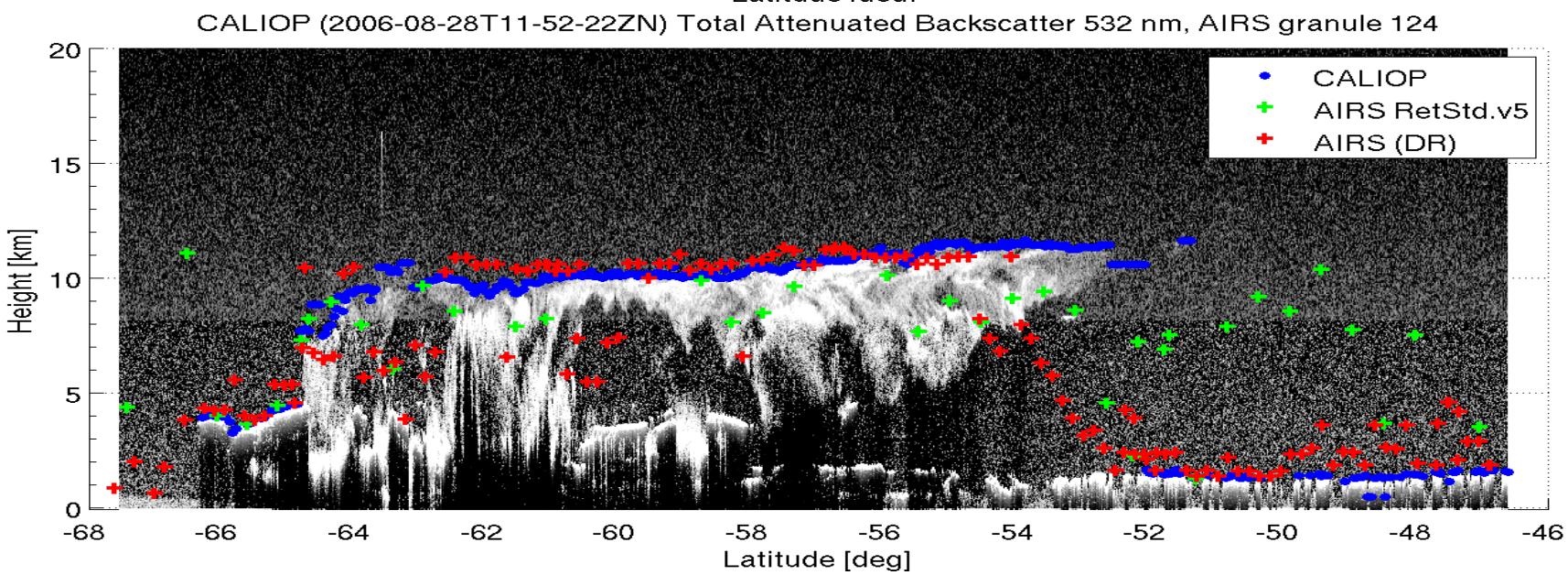
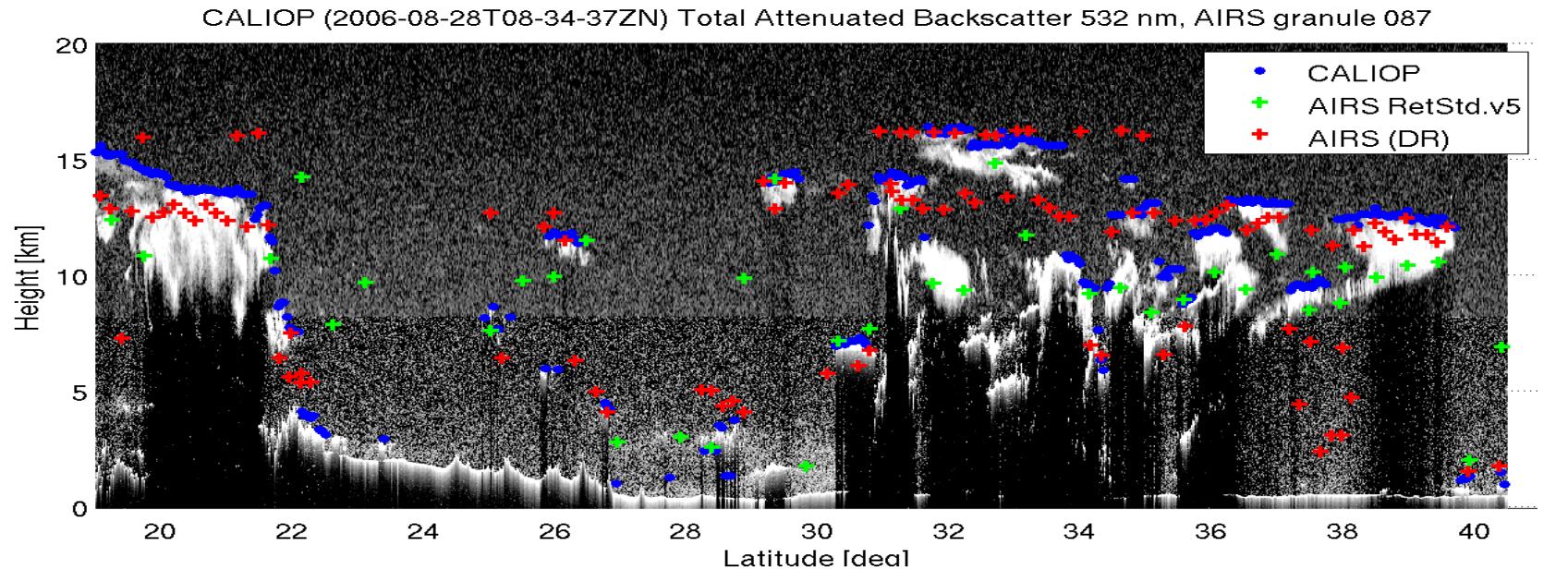
- Linearizes Cloud and Moisture Dependence through classification
- Based on single 40-yr Global Profile Data Set & Calculated Radiances



¹ Initial cloud-class selected from 8 200-hPa overlapping
cloud layer class regressions (solution is one closest to layer mean)

² Retrieval below cloud set equal to missing if Cld-OPD > 1.0

Comparison with LIDAR & RADAR

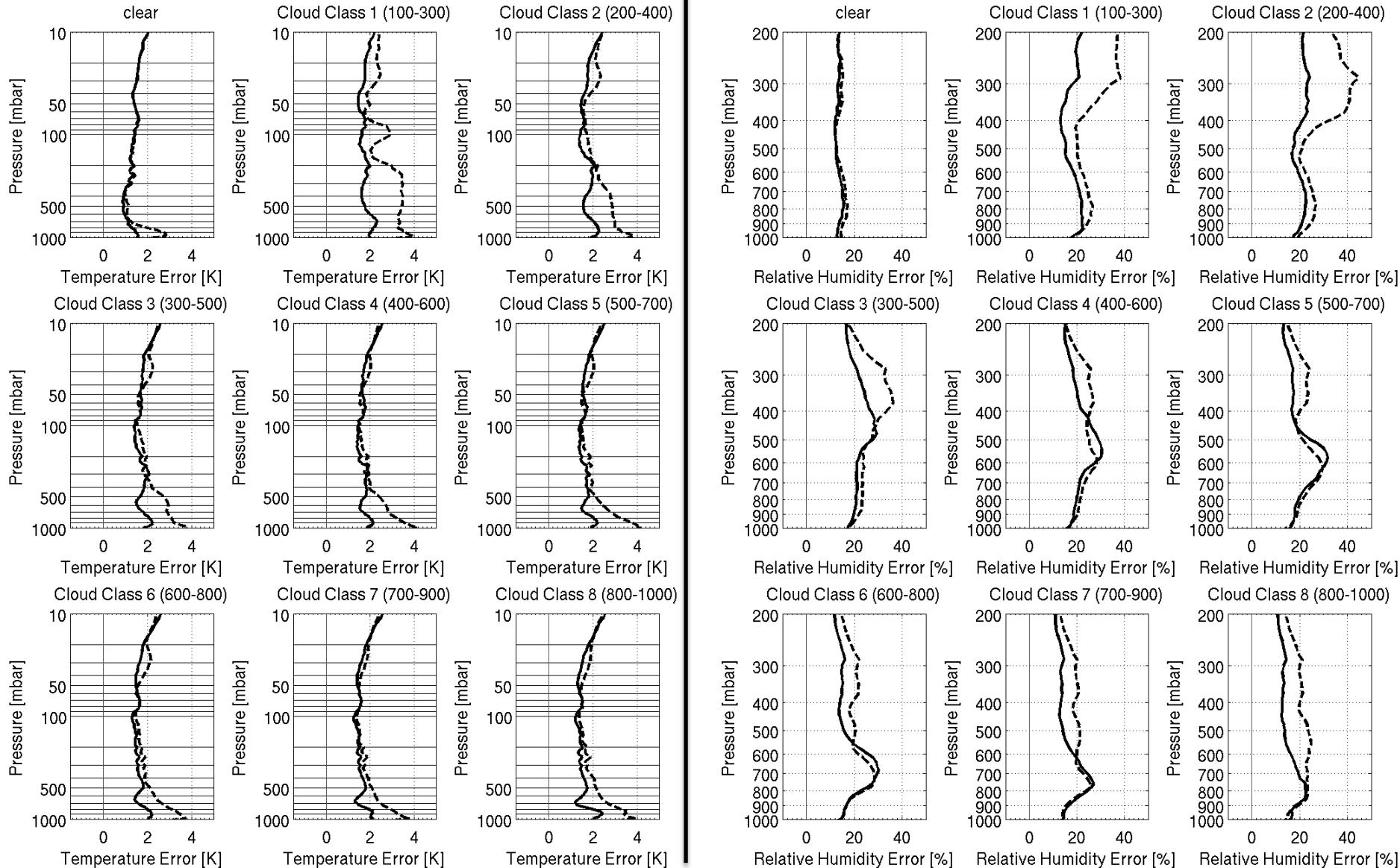


Retrieval RMSE (DR Vs Unstratified)

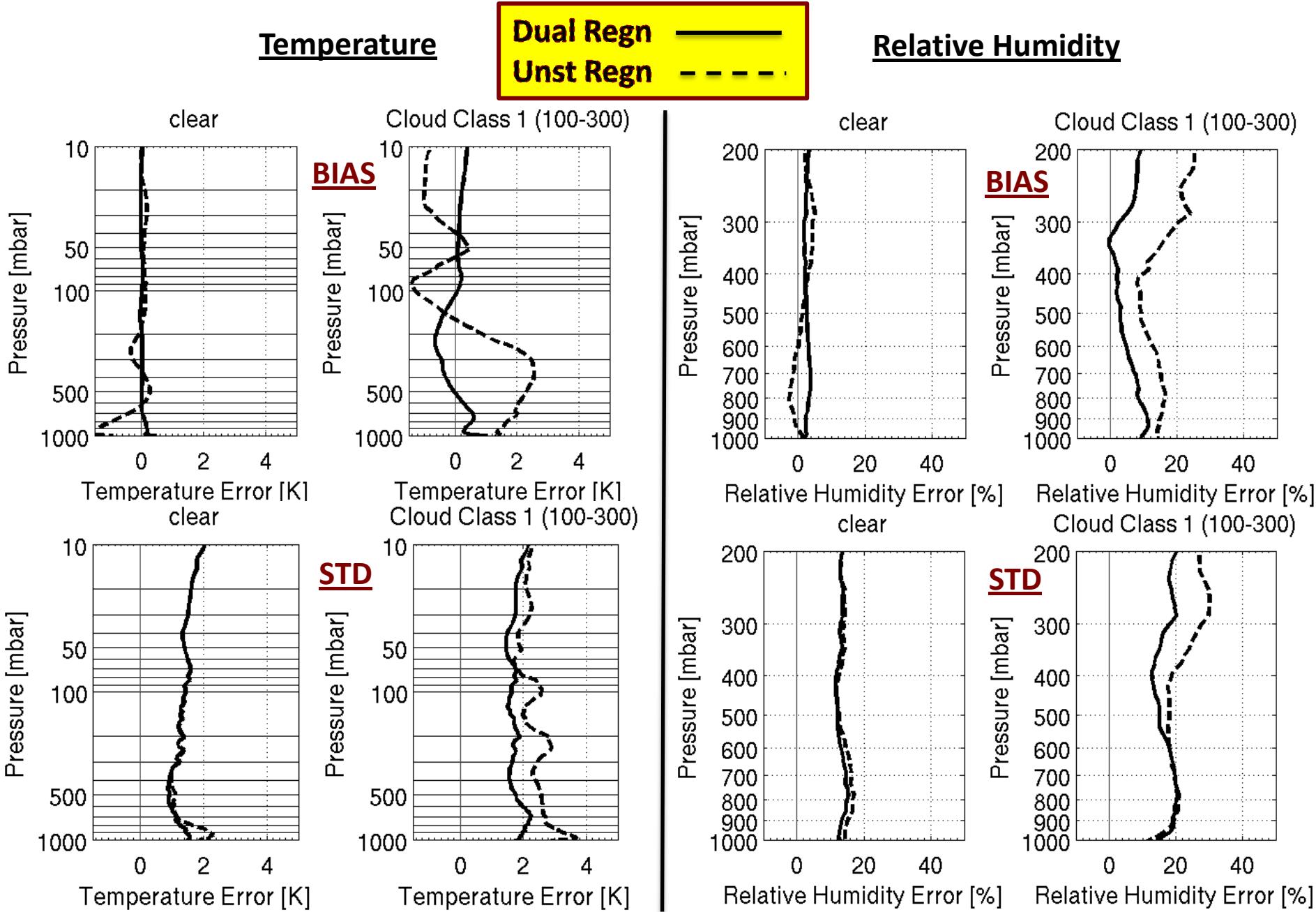
Temperature

Dual Regn —
Unst Regn - - -

Relative Humidity

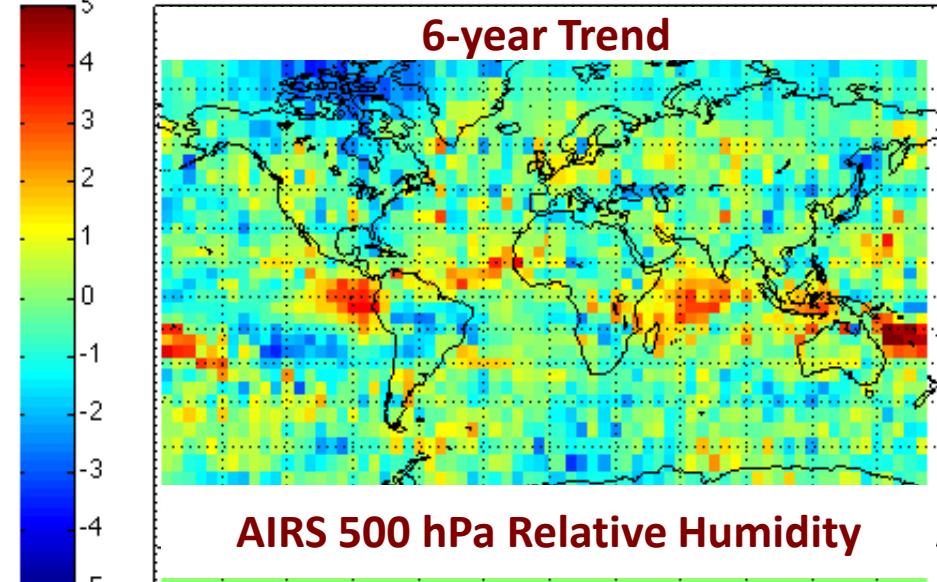
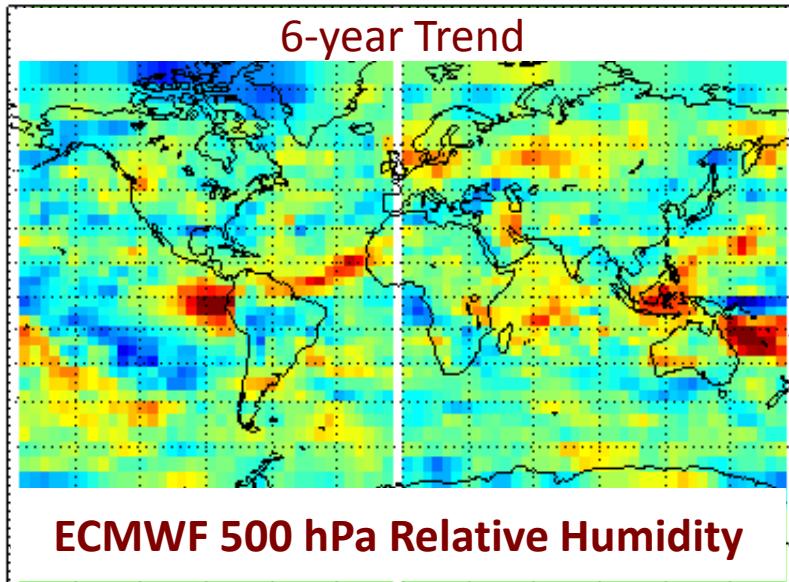
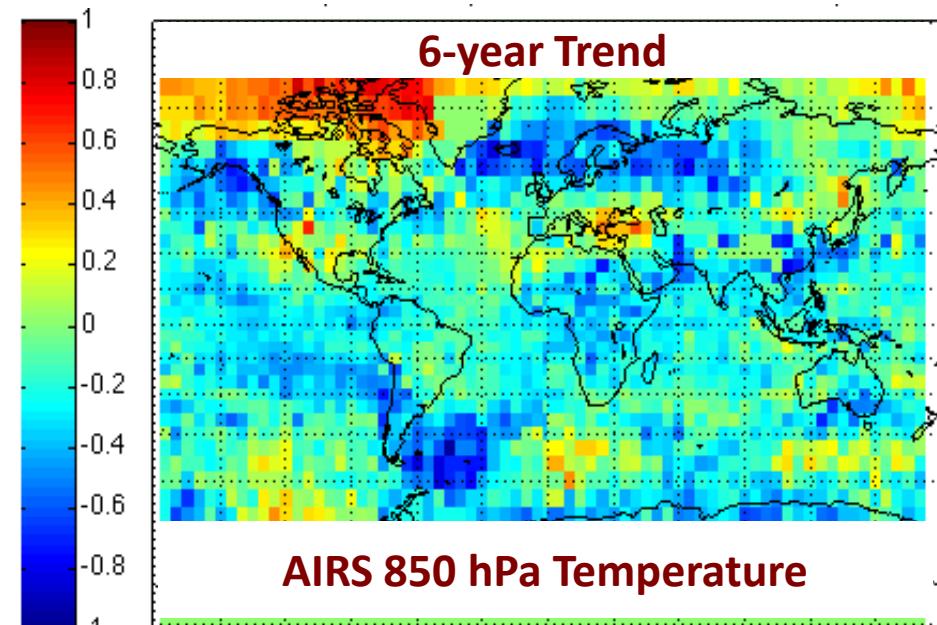
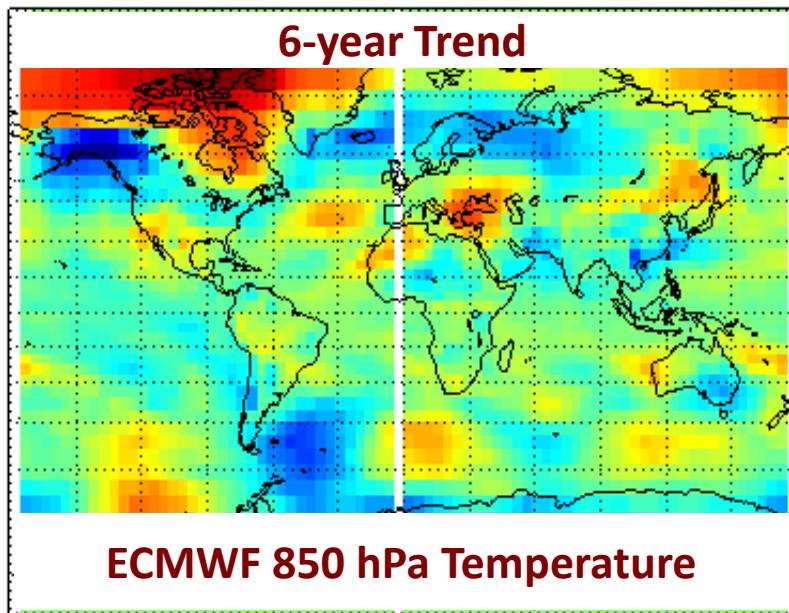


Retrieval Errors (DR Vs Unstratified)



850-hPa (1.5-km) T & 500-hPa (5-km) RH

EC Vs AIRS 6-yr (2003-2008) Trends (5 deg Feb + Aug Mean)



Global Mean Trends

(AIRS Vs CLARREO)

Parameter	AIRS (13-km)	CLARREO (100/100-km)	CLARREO (25/210-km)	Difference	
				100/100	25/210
850 T (K/yr)	-0.120	-0.198	-0.195	+0.078	-0.075
850 RH (%/ yr)	-0.366	-0.361	-0.352	+0.005	+0.014
500 T	-0.123	-0.125	-0.124	-0.002	-0.001
500 RH	-0.078	-0.106	-0.077	-0.028	+0.001
300 T	-0.070	-0.066	-0.065	+0.004	+0.005
300 RH	+0.071	+0.052	+0.023	-0.019	-0.048
50 T	-0.027	-0.026	-0.028	-0.001	+0.001

Future Work

- Fix CO₂ variance with constraint that the retrieved time variation to matches known time variation
- Produce 8-yr AIRS Climatology (2002 – 2012)
 - 25 km Nadir
 - 100 km Nadir
- Produce 4-yr IASI Climatology (2007-2010)
 - 25 km Nadir
 - 100 km Nadir
- Compare IASI Vs AIRS
 - Study Instrument & Diurnal Sampling Bias Effects
- Produce 40-yr IASI-IRIS Climate Change
 - Reduce IASI to IRIS space and spectral resolution